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I, ANNA MAIJA MADL, ACTING TEAM LEADER EXAMINATION SUPPORT & SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PP 7162 for a patent by BYRON AUSTRALIA PTY LTD filed on 17 November 1998.

WITNESS my hand this
Twentieth day of December 1999

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PROVISIONAL SPECIFICATION

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Invention Title: **Improved breakfast cereal biscuit.**

The invention is described in the following statement:

A feature of the BCBs is that the flattened grain flakes are visually discernible within the biscuit produced. This is a feature which distinguishes this type of BCB from shredded wheat biscuits wherein individual grains are not discernible.

Another type of grain-derived biscuit or cake can be produced from puffed whole grains, as described by Wu in US Patent No. 4,888,180. These products are produced from non-waxy rice, wheat, rye, corn and the like. The grains are conditioned to a predetermined moisture content, formed in a pre-heated mould and high temperature expanded. Consequently, the taste and texture of this product is quite distinct from the flaked grain BCBs. The puffed grain biscuits or cakes are also generally eaten in the form of a bread substitute, rather than with warm or cold milk, as is the case with the flaked grain BCBs.

Waxy grains have not generally been contemplated in the manufacture of BCBs. Waxy grains tend to become very sticky when hydrated during cooking and processing steps. This often results in the cooked waxy grains forming a glue-like material and sticking to surfaces of the cooking and processing apparatus. The difficulties associated with processing waxy grain has meant that non-waxy grain has been used in the preparation of BCBs.

There are a number of drawbacks with the BCB products currently available. One significant disadvantage is that when the BCB is combined with cold milk, the biscuit rapidly absorbs the milk and rapidly loses its crispy texture to become soft and mushy, usually within two to three minutes. The softened flakes also become capable of being dispersed into the milk very easily with a spoon. This short "bowl life", which refers to the time it takes for a cereal to become soft and mushy when immersed in cold milk, is considered by many consumers to be a disadvantage with BCB products. For example, compared with the bowl life of two to three minutes for known wheat flake BCBs, corn flake cereals generally have a bowl life of five to six minutes and oven crisped rice cereals (for example Kellogg's Rice Krispies, Kellogg Co. 235 Porter Street, Battle Creek, Michigan 49016, U.S.A.) generally exhibit a bowl life of six to seven minutes. Within the breakfast cereal industry, a bowl life of six to eight minutes is considered to be desirable.

In a particularly preferred embodiment the barley is hydrated to a moisture content of up to 30%, more preferably from 24 to 29%, most preferably about 29% w/w.

According to another embodiment of the present invention there is provided a process for production of a breakfast cereal biscuit comprising the steps of:

a) selecting grain which includes waxy grain in an amount of at least 20% by weight of total grain content;

b) hydrating and cooking said grain either sequentially or simultaneously or both;

c) rolling cooked grain into flakes;

d) agglomerating flakes into desired biscuit shape; and

e) toasting the product of step d).

Detailed Description of the Figure

The present invention will now be described by way of example only and with reference to the figure, wherein:

Figure 1 shows a diagrammatic representation of five highly preferred processing and product attributes of three breakfast cereal biscuit grains.

Detailed Description of the Invention

Throughout this specification, unless the context requires otherwise, the word "comprise", or variations such as "comprises" or "comprising" or the term "includes" or variations thereof, will be understood to imply the inclusion of a stated element or integer or group of elements or integers but not the exclusion of any other element or integer or group of elements or integers. In this regard, in construing the claim scope, an embodiment where one or more features is added to any of the claims is to be regarded as within the scope of the invention given that the essential features of the invention as claimed are included in such an embodiment.

grain. Preferably, however, at least 50% of the total grain weight will be comprised of waxy grain. More preferably at least 75%. Particularly preferably, waxy grain will comprise at least 90% of the total grain weight, and most particularly preferred is the situation where waxy grain is present in the BCB product to the exclusion of non-waxy grain. Preferably the waxy grain is waxy barley.

The general process followed in producing the breakfast cereal biscuits according to the invention is that the grain, which should be of good quality, is initially cleaned and graded as desired to ensure that it is free of infestations, dirt or stones. Grains which have hulls will need to be dehulled. It is then possible, if desired, to fully or partially remove the bran layer. For example, 10-15% of the outer bran may be removed. It is to be stressed however, that this removal of bran is purely optional, and is conducted in order to aid the process of hydration of the grain or to modify the eating quality of the final food.

It is also optional to crack the grain (without excessive damage) for example by passage through a roller mill. This process will aid moisture absorption.

The grain is to be hydrated and cooked, and these steps may be conducted separately or in combination. For example, hydration can be conducted simply by steeping the grain in water or conditioning to the require moisture content by methods well known in the grain processing industry. It is possible at this stage, if desired, to also add sugars, salts or other flavourings or additives for example by dissolving the added material(s) in the water absorbed. Following hydration the grain may be cooked, for example, in an autoclave or rotary steam pressure cooker. Equally however, the cooking may to be conducted without any prior hydration step, such that the hydration of the grain takes place during the cooking. Other materials such as sugars, salt, malt and other flavourings or additives may be added to the cooking process. The moisture content to which the grain is hydrated is dependent upon grain type. Preferably, the moisture content of the grain is increased to at least about 17-18% during the hydration and cooking stages depending upon grain type and characteristics desired in the final product. In some cases however, hydration of the grain may be substantially

"Agglomeration" is intended to mean the related processes of binding grain the flakes together and formation into the desired biscuit shape. In one form of the invention, agglomeration is achieved simply by allowing the flakes to fall onto a moving conveyor belt such that the flakes pile upon one another to form a mat of desired thickness. Naturally, the speed of the conveyor will determine the mat thickness. The flakes can then be passed through a press to compress the mat and to aid in binding the flakes together. It has been found that flakes produced from wheat are generally quite sticky due to addition of salt during the hydration or cooking phase. The added salt appears to aid in improving adhesion of the flaked grains in the agglomeration step. One advantage of using waxy grains like barley is that salt addition is not necessary in order to bind the grain flakes.

Once the mat of agglomerated flakes has been compressed to the appropriate thickness, it is possible for it to be cut into the desired biscuit shape. Generally, this will be a bar or cuboid shape although the formation of other shapes are equally possible if desired.

It is also possible for the agglomeration step to take place by placing flakes within perforated moulds of the desired shape, compressing the flakes and then removal of the shaped biscuit from the mould after toasting. This alternative process of agglomeration is somewhat more labour intensive than the formation of a mat which can be compressed and cut, although it does provide more flexibility in the nature of biscuit shapes which can be produced.

At the time of agglomeration it may also be appropriate for other components to be added to the biscuit. For example, it is possible at this stage, as mentioned above, for nutritional supplements such as vitamins or minerals, flavours, colours, salt, sweeteners and/or stabilizers to be added. It is also possible however, for other grains or grain products, nuts, fruits or fruit juices to be added and incorporated within the biscuit product. By other grain or grain products, it is intended to mean that for example, pre-rolled, pre-puffed or pre-toasted grains or grain components may be included within the biscuit form. The addition of such components may favourably alter the flavour and/or texture of the final BCB product.

products produced from non-waxy grains. This surprising result is of significant commercial importance, and means that the overall production costs of the BCBs of the invention is markedly reduced relative to that of known BCBs. For example, to manufacture BCBs from wheat, the cooking requirement was 75 minutes at 127°C followed by toasting at 160°C, 15 minutes. This contrasts the conditions for waxy barley which require to be cooked for 30 minutes at 125°C followed by toasting at 130°C for 15 minutes.

It has also been found that the BCBs produced from some waxy grains, especially those produced from waxy barley, develop an appealing malted flavour and rich golden brown colour, without the need of any additional sugars or malt in order to produce this improved flavour and colour profile. Importantly also, BCBs produced from waxy grains, and again particularly waxy barley, have significant nutritional benefits relative to the commercially available BCB product. Some waxy grains appear to contain an increased level of dietary fibre and particularly soluble fibre, relative to their non-waxy counterparts. For example, waxy barley contains 14.7% dietary fibre comprising 6% soluble fibre, whereas non-waxy wheat comprises only 11% dietary fibre and less than 1% soluble fibre (David Oakenfull, Food Applications for Barley, presented at 5th International Oat Conference and 7th International Barley Genetics Symposium, Saskatoon, August 1996). Waxy barley is also high in β-glucan content, which is a particularly beneficial form of soluble fibre (McIntosh, G. H. et al, Am. J. Clin. Nutr. 1991, 53:5, pp 1205-1209; Uusitupa, M. I. et al, J. Am. Coll. Nutr. 1992, 11:6, pp 651-659). Soluble dietary fibres are defined as the non-cellulose fraction of the NSP-hemicelluloses which include the (1→3) (1→4) mixed linkage (β-glucans, pectins, gums and mucilages (Oakenfull ibid).

A further, surprising attribute of the present invention is that product wastage is markedly reduced due to a reduced tendency for the BCB product to break or form dust. This has obvious economic benefits, as well as being appealing to consumers who will be less likely to receive broken or damaged products.

Another surprising attribute of the invention is that BCBs produced from waxy barley do not

desirable cohesiveness and textural characteristics of the three grains. Although wheat scored well in crispness, firmness and cohesiveness, it scored poorly in bowl life and had the highest energy consumption. Regular barley had the poorest rating in all categories except energy and bowl life, in which it rated better than wheat but worse than waxy barley.

The present invention will now be further described with reference to the following non-limiting examples.

EXAMPLE 1A

A ready to eat barley biscuit cereal product was made from a hulled variety of waxy barley having less than 10% amylose content and about 9-10% moisture content. The grain was lightly peeled (in an abrasive-type mill eg; Satake Engineering Company Ltd. Nishihon-machi, Saijo, Hagashi Hiroshima-shi. Japan) to remove the hull but not the bran layer. It will be understood that if a hulless type of waxy barley is used, the de-hulling step is not necessary. It was then hydrated in water to 29% moisture content. This was achieved by tumbling the grain with the appropriate volume of water until the grain had absorbed the entire volume of solution and the grains remain separate and integral (about 30 minutes at 24°C). The hydrated grain was then cooked in an autoclave in live steam at 125°C for 30 minutes to gelatinise the starch. The cooked grain was quite separate and integral at this stage. The hot grain was then passed through a roller mill set at a gap width between the rolls of 0.03 - 0.04 mm which compressed the grain to a flake. The roller mill had smooth rollers moving at identical speeds. The flaked grain was cohesive and stuck together when gently compressed. The flaked grain was packed into metal forms made from stainless steel mesh of the required dimension to give a suitable breakfast cereal biscuit (eg. 22 g cereal per 15x75x51 mm mould). The thus-formed biscuits were then toasted at 130°C with hot air blown through the biscuit to achieve even heat distribution throughout the biscuit for 13 minutes, by which time a light golden colour had developed. At this stage the product contained 2-3% moisture content. The volume of the biscuit was decreased by about 15% during toasting and was readily removable from the stainless steel mesh forms. This method

as in example 1A except the grain was prepared by hydration to 42% moisture content. This moisture content represented near complete hydration of the grain. This was achieved by steeping the grain in water at 50°C for the required time to reach 42% moisture (30 minutes). Alternatively the grain was hydrated during cooking by addition of the required water to the grain in the cooker. The grain was then cooked at either 121°C, 123°C or 125°C for 30 minutes. The grain was fully gelatinised at this point as judged by the lack of chalkiness in the grain interior. The grain produced from each condition could not be passed sucessfullly through a roller mill as in example 1A because it was too sticky, the grains were clumped together, stuck to the rolls and could not be processed into a breakfast cereal biscuit product. Alternatively, instead of rolling the grain directly out of the cooker, the grain was first dehydrated to a moisture content (less than 30% moisture) at which point the grains became separate and the dried grain could pass through the roller mill. These flakes required surface moistening to produce cohesive flakes and acceptable biscuits. However this method was deemed impractical as the grains would be too sticky to remove from a commercial rotary cooker.

EXAMPLE 1D

A ready-to-eat barley biscuit cereal product was prepared from the same barley grain as in example 1A except the grain was hydrated to either 25%, 29% or 35% moisture content and cooked at 121°C for 30 minutes. The grain was not fully gelatinised except for the 35% moisture content sample which was very sticky, would be difficult to remove from a rotary cooker and could not be used in subsequent steps without first dehydrating the grain as in example 1B. The remaining sample grain was then passed through a roller mill to produce flakes as in example 1A, except the resultant flakes were not cohesive and did not stick together and could not be used to form a successful biscuit product. The toasted biscuits were not crisp and tender and the flakes fell apart from the biscuit.

unacceptable.

EXAMPLE 2B

A ready to eat wheat biscuit cereal product was made from non-waxy regular whole wheat grains having a moisture content of 10% and a protein content of 11%. The grain was lightly peeled as before. It was then hydrated in water to 30% moisture content and 1.5% NaCl. This was achieved by tumbling the grain with the appropriate volume of water and salt until the grain had absorbed the entire volume of solution and the grains remain separate and integral (about 60 minutes at 24°C). The addition of salt to the solution increased the time needed for the grains to fully absorb the added solution. The hydrated grain was then cooked in an autoclave in live steam under the following regimes: 127°C for (a) 60 minutes and (b) 75 minutes.

The cooked grain of both samples was quite separate and integral at this stage and no chalkiness was evident. The hot grain was then passed through a roller mill set at a gap width between the rolls of 0.03 - 0.04 which compressed the grain to a flake. The resultant flakes in sample (b) were cohesive and easily stuck together when gently compressed in the palm of one's hand or in metal forms for toasting. This feature was considered optimal for the process. Flakes produced in sample (a) were less cohesive and did not stick together as well as in sample then (b) or as well as with waxy barley (Example 1A). Sample (b) was then packed into metal mesh forms and toasted at three different temperatures: 150°C, 155°C and 160°C for 15 minutes each. The resultant biscuits were all similar in bowl life of 3 minutes which is typical of commercial wheat biscuits. Only the sample toasted for 15 minutes at 160°C became fully dry, crisp and had developed a warm brown toasted colour. Sample (b) when toasted for 15 minutes at 160°C was considered acceptable and most similar to commercial wheat breakfast cereals. The energy expenditure required to produce an acceptable wheat biscuit (cook: 127°C, 75 minutes; toast: 160 C, 15 minutes) was much greater than that required for waxy barley (cook 125°C, 30 minutes; toast: 130 C, 13 minutes). In contrast to waxy barley (Example 1A), in order to achieve wheat flakes which

remain integral as they soften, maintaining at the same time the form of the integral biscuit.

Other variations with this barley cereal include flavouring the grains with fruit juice concentrates and/or adding dried fruits or other flavour components by incorporating them at various stages of the process. This invention allows for the addition of the heat-sensitive flavour and vitamin components to the already cooked grains. This may occur either prior to flaking or after flaking, after which only a minimal heating application at relatively low toasting temperatures need be used. Larger sized inclusions can be incorporated after flaking but before agglomeration prior to toasting. Alternately, the toasted biscuit may be enrobed for example with a chocolate or other coverture or the biscuits may be formed into a sandwich with a cream filling in between as for bakery biscuits or cookies. Even if the biscuits are made without any additions except water, the final waxy barley biscuit develops a warm golden colour. By contrast commercial non-waxy wheat biscuits are a grey brown colour even when sugar and malt have been added.

Efficiencies of Processing

Table 1. compares the minimum cooking parameters which are required to produce several grain biscuit types. Even after 50 minutes of cooking at 125°C, the non-waxy barley product was more dense, more fragile and had a raw starchy character when compared with the waxy barley product cooked for only 30 minutes. Also, the non-waxy barley biscuit was not as crisp and, as shown in Table 1, lost its crispness and became mushy more quickly than the waxy barley biscuit. Thus a significant energy saving is achieved as seen in a 40% reduction in cook time when waxy barley is compared with non-waxy barley. Additionally further efficiency derives from the increased capacity of cooking equipment by virtue of the shorter cook time per batch. A cook time of 30 minutes can reasonably be carried out using continuous cooking equipment whereas cook times of 50 minutes and more become uneconomical using continuous cooking equipment. The flavour of the non-waxy barley biscuit in Table 1 was not malty, slightly bitter and had a bland flavour. The organoleptic quality of the waxy barley biscuit was considered superior to the non-waxy barley biscuit.

waxy barley	8 minutes
non-waxy barley	5 minutes
commercial wheat	3 minutes

TABLE 2.

MINUTES	BARLEY WAXY	WHEAT NON-WAXY	BARLEY NON-WAXY
0	crisp, crunchy	crisp	crunchy
1	crisp, crunchy	soft, crisp	soft, crunchy
2	soft, crunchy	soft	soft, crunchy
3	soft, crunchy	mushy	soft
4	soft, crunchy	mushy	soft
5	soft, crunchy	mushy	mushy
6	soft	mushy	mushy
7	soft	mushy	mushy
8	mushy	mushy	mushy

EXAMPLE 4

A ready-to-eat corn (maize) biscuit cereal product was made from whole waxy corn grain. The whole grain was steeped in water at 80°C to a moisture content of 33%. The hydrated grains were then cooked in live steam at 128°C for 48 minutes to achieve gelatinisation. The cooked whole grains were passed while hot through a roller mill with a gap width (between the rolls) of 1.4 mm and then dried at 70°C to 26% moisture content. These partly dried grains were then tempered at 24°C in a sealed container for one hour and then rolled at a gap width of 0.12mm. This two step rolling regime aided in the efficiency of rolling large grains such as corn, and was also beneficial for producing fine whole flakes suitable for toasting into biscuits. However a single rolling operation using a gap of 0.12 mm is also possible. The flakes were packed into forms made from stainless steel mesh of the required dimension to

A breakfast biscuit cereal was made from a mixture of waxy barley and rye grain by combining 90% dehulled waxy barley with 10% non-waxy rye grains. This mixture was hydrated at 24°C with a solution containing 22.5% sucrose, 5.5% NaCl and 72% water to a moisture content of 18%. The hydrated grains were then cooked in an autoclave in live steam at 125°C for 30 minutes. The gelatinised grains were integral and separate at this stage and they were then passed through a roller mill while still hot at a gap width of 0.03-0.04mm. The flaked grain was immediately packed into forms (22g grain / 15x75x51mm mould) and toasted at 130°C for 15 minutes in a forced hot air toaster. The final barley and rye biscuits had a moisture content of 2-3%. They were light and crisp and tender in texture and a light golden brown colour with an attractive mix of darker rye grains throughout. The bowl life in cold milk was 8 minutes.

It is to be clearly understood that the present invention has been described by way of example only and that modifications and/or alterations which would be obvious to a person skilled in the art, based upon the teaching herein, are also considered to be included within the scope and spirit of the invention as described herein and defined within the appended claims.

a moisture content of about 29% w/w.

9. A process for production of a breakfast cereal biscuit comprising the steps of
   a) selecting grain which includes waxy grain in an amount of at least 20% by weight of total grain content;
   b) hydrating and cooking said grain either sequentially or simultaneously or both;
   c) rolling cooked grain into flakes;
   d) agglomerating flakes into desired biscuit shape; and
   e) toasting the product of step d).

10. A process as claimed in claim 9 comprising the additional step of adding one or more of other grain or grain products, nuts, fruits, fruit juice, nutritional supplements, flavours, colours, salt, sweeteners and/or stabilizers.

11. A process as claimed in either claim 9 or claim 10 wherein said waxy grain is selected from barley, corn, wheat, rice and/or sorghum.

12. A process as claimed in claim 11 wherein said waxy grain is barley.

13. A process as claimed in either claim 11 or claim 12 wherein said waxy grain comprises at least 75% by weight of total grain content.

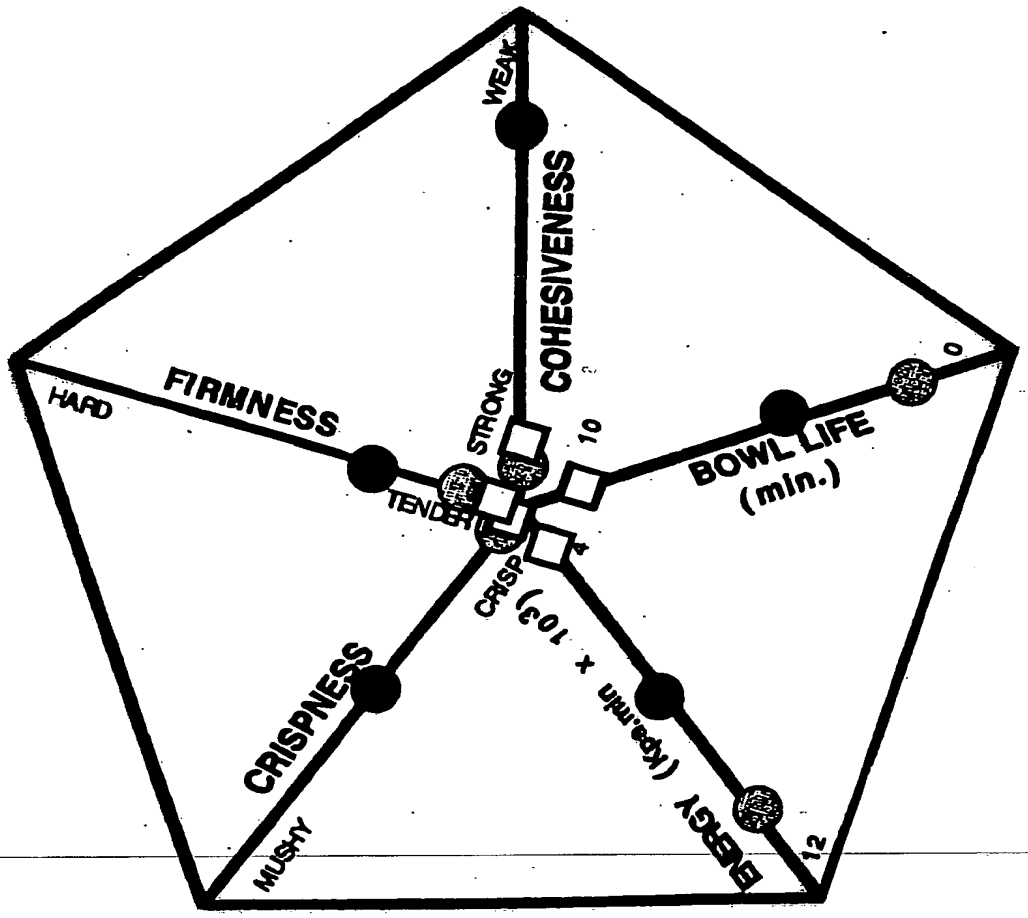
14. A process as claimed in either claim 11 or claim 12 wherein said waxy grain comprises at least 90% by weight of total grain content.

15. A process as claimed in either claim 11 or claim 12 wherein said waxy grain comprises 100% by weight of total grain content.

16. A process as claimed in any one of claims 12 to 15 wherein said barley is hydrated to a moisture content of up to 30% w/w.

17. A process as claimed in claim 16 wherein said barley is hydrated to a moisture content from 24 to 29% w/w.

18. A process as claimed in claim 17 wherein said barley is hydrated to a moisture content



WAXY BARLEY

WHEAT

REGULAR BARLEY

Figure 1